IGRIDS Education and Outreach

Rationale
The International Global Radar Imaging Data Service (IGRIDS) will provide us with new opportunities to pursue unanswered scientific questions related to Earth and space exploration. IGRIDS research, technologies, tools and resulting data hold the promise to advance knowledge while promoting innovative ways to expand imaginations, increase understanding, provide new educational opportunities, and enable better management of our natural resources on a local to global scale. We can create a solid rationale by underscoring the importance of a non-mission-based InSAR plan through four process goals:

Awareness
We need to answer some very basic questions to raise public awareness, beginning with "Why InSAR?" What can InSAR provide that other technologies can't? What was life like before InSAR? How will life improve with InSAR? In addition, we need to develop *concrete examples* linked to *hooks* such as "…single most valuable tool that Earth scientists can provide to world geological hazard mitigation."

- *Provide examples of products* for the public sector according to audience types
- *Create products to publicize* importance of InSAR (reports, brochures, news articles, TV/film/video production)

Understanding
Our goal to deepen understanding at all levels should result in programs that inspire the next generation of scientists; stimulate national science literacy and learning; advance public understanding of benefits of InSAR technology and uses; and promote understanding of the long term benefits of InSAR (i.e., space exploration / including Earth and beyond).

Friends
"Friend-raising" is the first step toward creating truly beneficial partnerships with sustainable results. In our outreach effort, we should aim to recruit potential collaborators in all sectors, thereby increasing potential use of research results and data output. Partnerships also may lead to increased awareness, understanding and provide pathways to finding additional resources.

Funds
The fourth process goal will be to seek interim funding for support of planning workshops, strategic planning, and proposal(s) development.

IGRIDS Education and Outreach: Introduction
We propose a broad Education and Outreach (E&O) effort that operates as an integral part of IGRIDS. Our motivation is based on the urgent need to increase public awareness, improve understanding of InSAR science, technologies and data, enhance existing InSAR-based partnerships and create new collaborations across all sectors, and increase available resources to support all mission-based and non-mission-based related activities.

The IGRIDS E&O effort will aim to ensure and enhance full use of the InSAR results by the

general public and specific users. We will assemble a special E&O Working Group whose charge is to create a strategic plan that clearly states our goals for serving the InSAR scientific community while achieving broad audience participation in InSAR-related programs outside the context of specific missions.

Audiences and the Consensus Process

We envision a comprehensive set of IGRIDS formal and informal education and knowledge transfer programs with projects and activities tailored to specific audiences (Fig 1). These would be based on feedback obtained through an iterative process among scientists, educators, and audience representatives that results in a solid IGRIDS E&O strategy. Questions to consider in this effort may include

- What specific activities are best for each audience? [in focus groups, ask both scientists and audiences]
- What are their challenges and needs?
- How can our research agendas help overcome those challenges and meet those needs?
- What communication and dissemination methods should be used?
- What societal role should we jointly pursue?

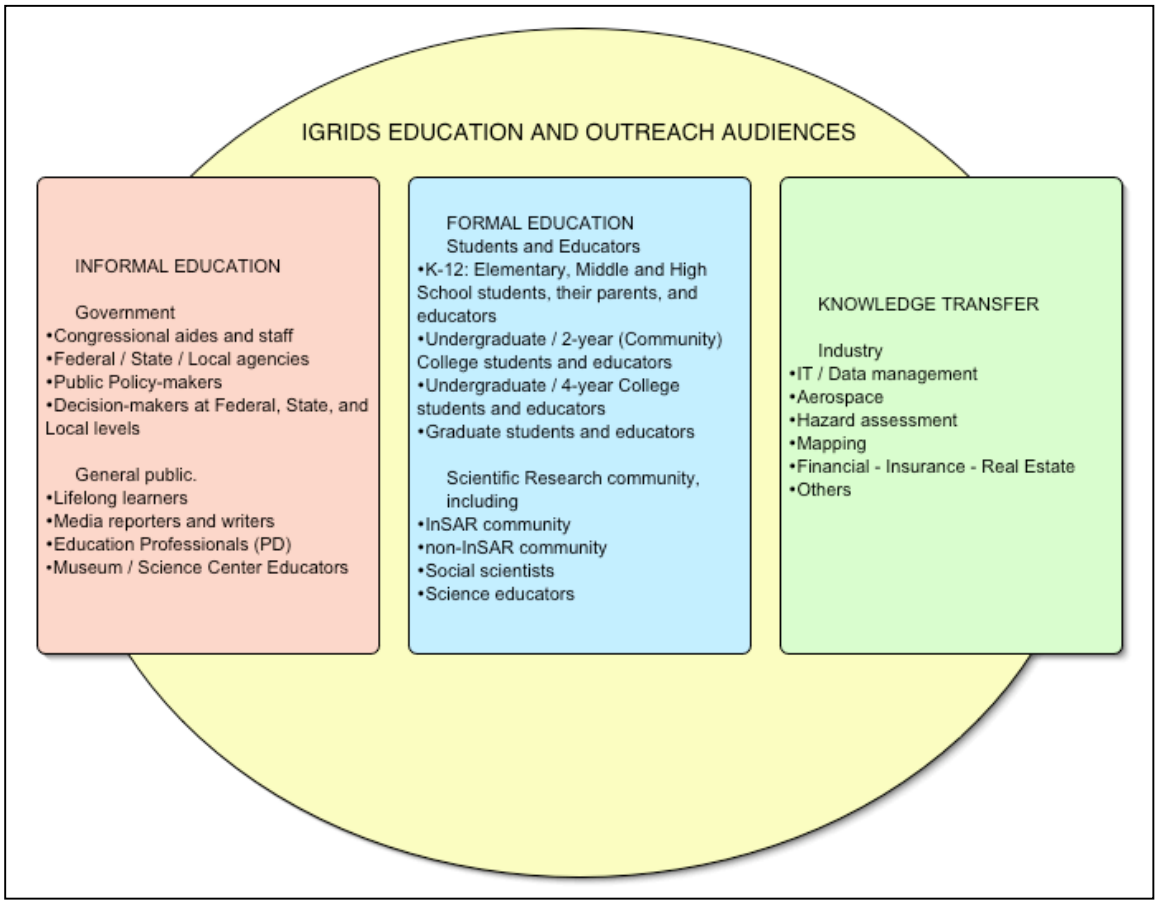

Fig. 1

For example, we may use the following process to work toward identifying and achieving our goals and objectives.

Conduct an ***internal investigation*** to identify SAR/InSAR researchers' unique source strengths and characteristics. We started this process at the October 2004 Workshop. Working groups may continue the process with specific answers to the following:

- What are the research objectives?
- What are the key projects or potential products?
- What are the significant and/or unique capabilities of the group?
- What successful activities and/or methods have been previously used to disseminate research results?
- What funding levels are required or recommended?

Once internal consensus is achieved among investigators, we could ***identify audiences*** – people who have the capability to use SAR/InSAR research results.

- Results need to be packaged to fit different audiences.
- Successful outreach depends on whether each target audience has innate or acquired ability to adopt and implement results.

To choose the right audiences, we can use the time-tested process of forming ***focus groups*** made up of representatives from each targeted audience and invite them to participate in one or more workshops.

- Increases credibility in the community
- Promotes faster adoption of new information

Using methods such as Delta or Nominal Group Technique, we can acquire a significant amount of information in a very short period of time.

Our focus groups can then help us ***initiate*** outreach program planning, with intentions to 1) to achieve consensus among each other with input from research community leadership; and, 2) to focus on simple, practical, timely and cost-effective solutions.

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We would then continue ***interaction*** with our focus groups (some become advisory groups) to stay current with their needs and to solicit advice and feedback via structured evaluation processes. Areas of input may include

- best methods of communication;
- identification of linkages or opportunities with others; and
- help with creating management policies that enhance education and outreach efforts on a continuing basis.

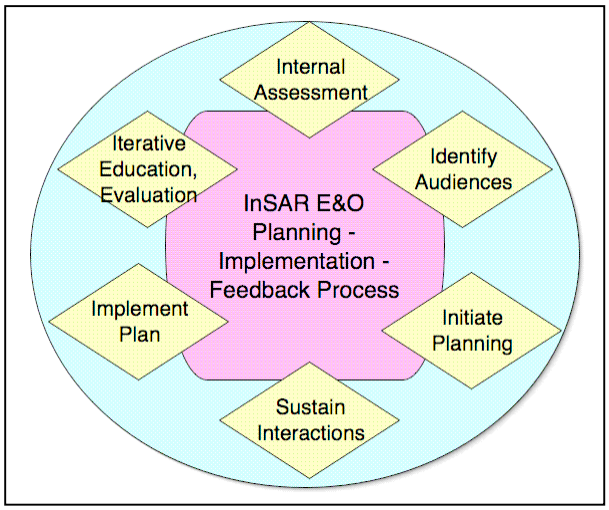
Next, we could create a strategic plan, timeline and related budget for ***implementation***.

- Fit the plan to overarching vision, mission, objectives of the research.
- Consider feasibility of each project or product suggested by focus groups and advisers.

- Take into account time required for the program or project (researchers already maintain over-full schedules), availability of resources (can they be leveraged?), and internal and external capabilities.
- Select the kinds of programs, projects and activities that encourage two-way communication while providing participants a variety of ways to stay in touch with the researchers and the results of their efforts.

To provide continuity and promote sustainability, we would incorporate an ***iterative*** process where both researchers and audiences actively *educate each other*. Results are

- Usable, innovative products;
- Strengthened linkages across all sectors;
- Collaborative partnerships; and
- Expanded opportunities.



The iterative process also advances the concept of *joint ownership* among disparate groups. This in turn can lead to *consensus and implementation* of mutually identified priorities for product development and dissemination. (Fig. 2)

Figure 2.

Program Types for Specific Audiences

Formal Education. Audiences identified are

- K-12: Elementary, Middle and High School students, their parents, and educators
- Undergraduate / 2-year (Community) College students and educators
- Undergraduate / 4-year College students and educators
- Graduate students and educators

To extend our reach and ensure long-term scientific support of InSAR, we will work with each user group to construct the necessary educational products and programs designed to inspire the next generation of scientists, and stimulate national science literacy and learning. New courses, curricula and lesson plans may be created for pre-college, undergraduate and graduate students and educators. We propose to work on all levels with educators who can incorporate InSAR data and related science into teaching. Two examples follow.

K-12 Teacher Training. We may propose a comprehensive teacher training program to incorporate InSAR results into precollege curricula. Research in learning clearly underscores the need to teach through a “hands on” or “inquiry-based” approach. In K-12 education, the National Science Education Standards place learning about scientific inquiry first, as a

foundation for meeting science content standards. In grades 9-12 there are two Inquiry Standards: understanding the nature of scientific inquiry, and gaining the ability to make scientific inquiries. Students (and educators) who learn through inquiry most often go on to understand what it means to practice science. In "Before It's Too Late," the report of the National Commission on Mathematics and Science Teaching in the 21st Century, teaching through "the process of inquiry, not merely giving instruction" is held up as the standard and is judged to be largely unmet in the nation's schools. As new inquiry-based materials are introduced to high school science curricula, we may be able to help teachers more effectively use them. We may propose to provide cadres of high school science teachers with summer "Inquiry Institutes" in IGRIDS partners' university teaching labs, which are largely unused during the summer. Paired with InSAR research faculty and postdoctoral scholars, teachers will spend five weeks in lab courses designed to introduce to them InSAR "basics." We propose follow-on meetings during the school year, led by master teachers. If successful, the IGRIDS Inquiry Institute could be a model to be adopted by engineering and science faculties in universities across the country.

University Courses. At the university level, we may propose new courses that focus on InSAR technology and data interpretation in order to redirect interested students from diverse engineering and science disciplines. The aim of such a course would be to give students an appreciation of InSAR technology early on, motivate the students to enter this field, demystify the technology, and spark their interest in the more rigorous aspects of the field. InSAR-based coursework could ultimately spark creativity and expand the interdisciplinary flavor of laboratory exercises as well as provide many new opportunities for undergraduate research.

Informal Education. Audiences identified are

- *General public, including*
    - *Lifelong learners*
    - *Media reporters (print, electronic, radio)*
    - *Writers*
    - *Filmmakers*
    - *Education Professionals (PD)*
    - *Museum and Art Gallery Curators and Educators*
    - *Science Center Educators*

A largely non-scientific public needs to know how InSAR will benefit society as a whole. We propose the immediate launch of a publicity drive that captures the essential elements of InSAR science while sparking national and international interest in providing long-term support. Questions we should consider as we develop the publicity effort should include

- What are the truly important, challenging and *exciting* questions related to InSAR E&O?
- Why should our tax-paying audiences care about / pay for SAR/InSAR-based research?
- How does InSAR-related E&O / access to data output benefit the global scientific community?
    - each target audience?
    - society as a whole?

Knowledge Transfer. Audiences identified are

- *Scientific Research community, including*
    - *InSAR community*

  - *non-InSAR community*
  - *Social scientists*
  - *Science educators*
- *Industry, including (but not limited to)*
  - *IT / Data management*
  - *Aerospace*
  - *Hazard assessment*
  - *Mapping*
  - *Financial - Insurance - Real Estate*
  - *Others*
- *Government, including*
  - *Congressional aides and staff*
  - *Federal Government agencies*
  - *State / Local agencies with E&O personnel*
  - *Forest Service / Rangers*
  - *State Parks*
  - *Public Policy-makers*
  - *Decision-makers at Federal, State, and Local levels*

A well-integrated, coordinated knowledge transfer effort is essential for disaster mitigation and resource management. Included in the effort should be the following:

- *A mission-related merit review* in terms of product development and output
- Creation *of web-based databases on all activities* related to InSAR output
- Ways to provide *broad access to consistent, high level data products* for multiple uses (e.g., interoperability, standards in science and industry)
- Ways to identify *protocols/parameters* required to develop a standard for data usage
- Ways to incorporate *existing industry uses* of the technology and data

Disaster mitigation. InSAR data for disaster mitigation (e.g. volcanoes, earthquakes, and floods) requires rapid, time-critical awareness and understanding of the results across the spectrum of emergency managers, hazard reduction specialists and decision makers. Through a series of initial focus groups and the process of collective inquiry and consensus building among audience representatives, we will identify what product types are most cost-effective and have potential for broad-based dissemination. These include building working partnerships among relevant agencies; workshops; seminars; and development of training courses and materials.

Environmental Awareness, Management, and Research. InSAR is already an effective tool for monitoring important and increasingly critical resources such as ground water and hydrocarbons. Many potential users in decision-making positions (i.e., county-level hydrogeology staff people) lack the expertise to realize the full potential of InSAR data. An effective IGRIDS Knowledge Transfer effort can develop ways to provide results in understandable formats that reduce the need for advanced training, as well as open opportunities for appropriate training.

Education of the Scientific Community. Equally important is the immediate need to expand and deepen scientists' understanding of InSAR technology and benefits. The existing community of InSAR scientists is small in relation to a much larger scientific community that wants and needs to know how to interpret and use InSAR tools, technologies and resulting data. We propose a pre-InSAR mission(s) series of seminars and workshops that will serve to close the knowledge gap in the research communities and promote wider access and use

of data. Currently, InSAR processing and data interpretation is an esoteric skill set that remains the province of relatively few people and takes considerable effort to acquire. This has served as a barrier to more widespread use of InSAR and datasets in the community. By reducing these barriers, a focused outreach effort can broaden the use of InSAR to a wider community. We expect that this will greatly increase the number of applications in the future to communities that currently make little, if any use, of InSAR. An example of this is GPS, which was originally developed for a very specialized audience but is now nearly a ubiquitous technology in the everyday life of most citizens.

One approach is to educating the research community is to integrate the E&O effort with the InSAR software and IT development. This may serve to minimize software difficulties and provide associated documentation appropriate for the skill levels of each user group. Workshops and other training mechanisms can be simultaneously developed and presented. To maximize benefit, we propose a “train the trainer” approach: a high-level intensive course will be provided to selected groups who will then serve as local experts in their work environments.
